Engineering Statement
Petition to Modify Market
of WMDE(DT) Ch. 5 Dover, DE
prepared for
CoxCom, LLC

This statement has been prepared for *CoxCom,LLC ("Cox")* in connection with *Cox's* Petition for Special Relief requesting modification of the mandatory carriage market of digital television station WMDE, Channel 5, Facility ID 189357, Dover, DE. This statement supplies location and distance data for communities served by *Cox's* cable television system in Fairfax County, VA ("the *Cox* Communities") and various determinations and analyses of WMDE's predicted coverage of the *Cox* Communities and affected DMAs.

FCC licensing data for WMDE shows the technical parameters listed below.

Summary of WMDE technical parameters

License File Number	0000001038
Channel	5 (76 – 82 MHz)
Principal Community	Dover, DE
Antenna Structure Registration Number	1037392
Site Coordinates	38-57-17.8 N 76-05-33.7 W (NAD 83) 38-57-17.3 N 76-05-34.8 W (NAD 27)
Antenna Center of Radiation Height	137 meters above ground 154.1 meters above mean sea level 145 meters above average terrain
Effective Radiated Power	10 kW nondirectional

A system boundary map for Fairfax County VA, supplied by *Cox*, is provided in the attached Figure 1. Those boundaries are reproduced on Figure 2, which includes the location of WMDE's principal community, Dover, DE. Figure 2 also depicts the boundaries of the Washington DC Designated Market Area ("DMA[1]"), which encompasses the *Cox* Fairfax VA system.

For digital television stations, the relevant coverage contour level is described in 47 C.F.R. 73.622(e) for DTV service, known as the noise limited service contour, ("NLSC"). For the case at

[1]DMA is a registered service mark of The Nielsen Company.

hand, WMDE is on Low-Band VHF Channel 5 and the corresponding NLSC is 28 dBμ. The WMDE NLSC is plotted on Figure 2, pursuant to the method specified in §73.625 utilizing 3-arc second digitized terrain data and the propagation curves for Low-Band VHF television in §73.699.

Figure 2 also depicts the boundaries of the Baltimore MD and Philadelphia PA DMAs. WMDE's principal community of Dover DE is within the Philadelphia DMA and the WMDE transmitting location is within the Baltimore DMA.

WMDE's NLSC (28 dBμ) encompasses a land area of 4,172 square kilometers within the Washington DC DMA, which is 13.0 percent of the 32,212 sq km total land area of the Washington DC DMA. The WMDE NLSC covers 87.4 percent of the Baltimore MD DMA (9,249 sq km land area of the total 10,578 sq km land area within the DMA) and 14.9 percent of the Philadelphia PA DMA (3,173 sq km land area of the total 21,246 sq km land area).

Figure 3 depicts the boundaries of the Fairfax County *Cox* system and includes certain community boundaries within Fairfax County that are served by *Cox*. Figure 4 provides a map showing the locations of the Cox communities with respect to Dover, DE (WMDE's principal community). The various *Cox* communities are listed below, with their respective distances from Dover based on each community's 2010 US Census reference point, or location as noted. The average distance to these locations is 157.7 km (98.0 miles).

	Distance from Dover, DE Reference Point Distance	
Cox Communities	**(km)**	**miles**
Fairfax County - Closest Point	138.5	86.1
Fairfax County - Farthest Point	174.5	108.5
Fairfax County Government Center[2]	162.4	100.9
Falls Church (reference point)	146.2	90.9
Vienna (reference point)	153.1	95.2
Fairfax City (reference point)	157.5	97.9
Herndon (reference point)	162.6	101.1
Clifton (reference point)	166.8	103.7
Average:	157.7	98.0

[2]located at 12000 Government Center Parkway, Fairfax, VA.

As demonstrated on Figure 3, the WMDE NLSC (28 dBμ) does not reach four of the *Cox* communities (Vienna, Fairfax City, Herndon, and Clifton). The WMDE NLSC covers only 11.5 percent of Falls Church (0.6 sq km out of 5.2 sq km total). The WMDE NLSC covers 10.9 percent of the total system area (portions of Fairfax County served by *Cox* and the Cox communities), covering 99.1 sq km out of a total system area of 909.7 sq km.

Longley-Rice Coverage Predictions

Supplemental coverage predictions of WMDE's signal are provided herein based on the Longley-Rice methodology (Irregular Terrain Model / National Bureau of Standards Technical Note 101). Terrain features within 3.2 km (2 miles) and beyond 16.1 km (10 miles) of the transmitting location are ignored by the standard FCC NLSC methodology, and the terrain between 3.2 and 16.1 km of the transmitting location is only averaged to create a rough approximation which in turn sets the contour distance. The Longley-Rice method of coverage prediction is frequently utilized to supplement the standard NLSC coverage contour in determining the expected service area of a television station. Among other things, it takes into account all of the intervening topography of the terrain between the transmitting and receiving locations.

Version 1.2.2 of the Longley-Rice computer code was employed for the supplemental coverage predictions.[3] Predicted signal levels were computed for a 0.1 km grid using a terrain increment of 0.1 km with NED 3 arc-second digitized terrain data.

The Longley-Rice coverage predictions are supplied in Figure 5 and the detail map of Figure 6. Color tinting describes the signal levels predicted by the Longley-Rice methodology for a 28 dBμ threshold of service and at 10 dB increments for higher signal levels. According to the Longley-Rice methodology, 48.8 percent of the total Cox system area is predicted to receive signal levels from WMDE of 28 dBμ or higher (443.7 sq km of 909.7 sq km total).

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[3]Computer code for the Longley-Rice point-to-point radio propagation model is published in an appendix of NTIA Report 82-100, "*A Guide to the Use of the ITS Irregular Terrain Model in the Area Prediction Mode,"* authors G.A. Hufford, A.G. Longley and W.A. Kissick, U.S. Department of Commerce, April 1982. Some modifications to the code were described by G.A. Hufford in a memorandum to users of the model dated January 30, 1985. With these modifications, the code is referred to as Version 1.2.2 of the Longley-Rice model.

The location of the *Cox* system principal headend is marked on Figure 6. The Longley-Rice predicted signal level at this location is 30.4 dBµ, which is just above the 28 dBµ minimum threshold established by the FCC. According to a representative of *Cox,* attempts by *Cox* to receive WMDE at the headend location have been unsuccessful. No reception of WMDE was possible utilizing a properly oriented receiving antenna mounted at 200 feet above ground level on the headend tower structure (FCC ASR# 1035358).

Signal Strength Tests

Cox commissioned the firm of Meintel, Sgrignoli, & Wallace, LLC ("MSW") to conduct signal strength testing of the WMDE signal at various locations within the Fairfax system area. The MSW report, supplied separately, shows that no reception of WMDE was possible at any of the fifteen locations surveyed. The measurements involved a receive antenna elevated thirty feet above ground level using a DTV Field Test Vehicle with a pneumatic mast, a Rhode & Schwarz FSH-3 TV analyzer, and a DTV test receiver (see MSW report for complete detail). The attached Figure 7 depicts the locations of all fifteen measurement points. Despite the Longley-Rice signal predictions that adequate signal levels would be available for reception at nearly all of these locations, the measurement program showed that reception of WMDE's signal was not possible at any of the fifteen locations.

Practical Low-VHF Reception

It is well established that the FCC's planning factors for satisfactory digital Low-VHF reception are overly optimistic and thus overestimate the resulting service area and population. According to §73.622(e) and FCC OET Bulletin 69, a signal level of 28 dBµ is sufficient for reception. However that signal level does not consider the effect of manmade noise which is prevalent in the Low-VHF band (*i.e.,* electrical noise from nearby electric devices such as lights, household appliances, computers, personal electronic devices, and other consumer electronics). It has even been found that some digital television receivers emit electrical noise within the Low-VHF band.

The FCC has acknowledged that Low-Band VHF digital stations such as WMDE are suffering from the inability to provide service replication on those channels. In ET Docket 10-235, the Commission described in part the challenges faces by Low-VHF stations such as WMDE (FCC 10-196 at para. 42-45)[4] and sought comments on increased maximum power limits for VHF stations to help overcome reception problems. The FCC's June 23, 2010 "Broadcast Engineering Forum"[5] discussed the practical factors related to a 20 dB power increase for Low-VHF stations. The amount of power increase (20 dB) was not an issue or in dispute during the forum, rather the forum addressed the practical issues in implementing a 20 dB power increase to aid Low-VHF reception. In the forum, it was clear that a substantial power increase would be needed to make Low-VHF stations viable. It can be concluded from this effort that a 20 dB correction would be needed to the FCC's planning factors for successful Low-VHF reception, making the required receive signal level 48 dBµ which is a 20 dB increase over the 20 dBµ specified in §73.622(e).

Published reports provide additional data regarding a correction to the FCC required signal level. For example, according to the ATSC,[6] field tests "have shown that the minimum decodable signal levels are well above those planned for." For Low-Band VHF Channel 2, ATSC reports that the required signal strength is at least 12 dB higher than the FCC's specified value of 28 dBµ for service. An IEEE Transactions[7] report regarding the planning factors concludes that there is a "shortfall of at least ... 10 dB in the low VHF range."

The MSW report notes the presence of electrical noise at many of the measurements locations. While there is a wide range in the amount of recommended correction that could be applied to the FCC's planning factors for Low-Band VHF reception, a 12 dB correction to the threshold reception signal level will be applied herein for WMDE's predicted coverage. The above-

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[4] "*Innovation in the Broadcast Television Bands: Allocations, Channel Sharing and Improvements to VHF,*" Notice of Proposed Rulemaking, ET Docket 10-235, FCC 10-196, released November 30, 2010.

[5] "*FCC Announces June 25 Broadcast Engineering Forum,*" News Release, June 9, 2010.

[6] "*Performance Assessment of the ATSC Transmission System, Equipment and Future Directions*" Advanced Television Systems Committee (ATSC), April 12, 2001 Revision 1.0.

[7] "*Planning Factors for Fixed and Portable DTTV Reception*" Oded Bendov, Yiyan Wu, Charles W. Rhodes, and John F.X. Browne," IEEE Transactions of Broadcasting, Vol. 50, No. 3, September 2004.

referenced reports and presentations suggest corrections ranging from 10 dB to 20 dB. In the opinion of the undersigned, it would be appropriate to select a higher correction (in the order of 20 dB), however the 12 dB correction will be employed herein as that amount cannot be considered as excessive based on the published reports and post-transition experience. Applying a 12 dB correction to the Low-Band VHF threshold reception signal level results in a more practical 40 dBµ signal level threshold for WMDE's Channel 5 service (28 dBµ plus 12 dB = 40 dBµ).

Additional Longley-Rice maps are supplied, as Figure 8 and the detail map of Figure 9. These maps depict the predicted WMDE service based on a 40 dBµ minimum signal level. Analysis shows that only 4.7 percent of the total Cox system area would receive signal levels from WMDE of 40 dBµ or higher (43.2 sq km of 909.7 sq km total). The FCC contour at 40 dBµ does not reach any of the Cox Fairfax system area.

Certification

Under penalty of perjury, the undersigned hereby affirms that the foregoing statement was prepared by him or under his direction, and that it is true and correct to the best of his knowledge and belief. Mr. Davis has over 30 years of radio engineering experience, is president of *Chesapeake RF Consultants LLC*, is a Registered Professional Engineer in Virginia, holds a Bachelor of Science degree from Old Dominion University in Electrical Engineering Technology, and has submitted numerous engineering exhibits to various local governmental authorities and the Federal Communications Commission. His qualifications are a matter of record with that agency.

Joseph M. Davis, P.E.
May 19, 2015

Chesapeake RF Consultants, LLC
207 Old Dominion Road
Yorktown, VA 23692
703-650-9600

List of Attachments

Figure 1	Cox Fairfax, VA System Area Boundary Map
Figure 2	DMA and Cox System Boundaries
Figure 3	Cox System Boundaries – Cox Communities
Figure 4	Cox Communities – Distance from Dover, DE
Figure 5	Predicted Longley-Rice Coverage – WMDE
Figure 6	Predicted Longley-Rice Coverage – Detail – WMDE
Figure 7	Measurement Point Locations
Figure 8	Predicted Longley-Rice Coverage – 40 dBμ Signal Level – WMDE
Figure 9	Predicted Longley-Rice Coverage – Detail – 40 dBμ Signal Level – WMDE

Figure 1
Cox Fairfax, VA System Area Boundary Map
Provided by CoxCom, LLC

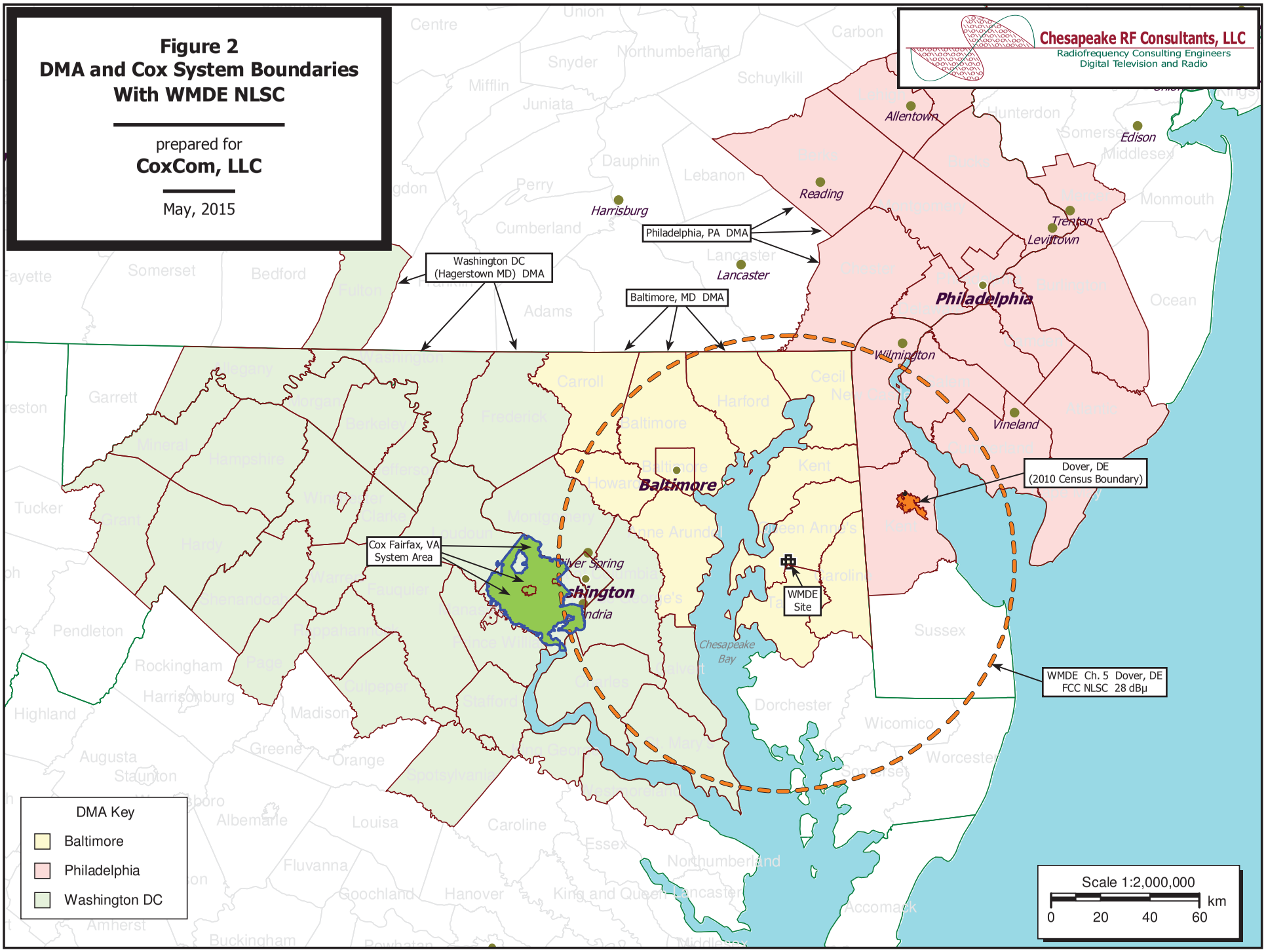
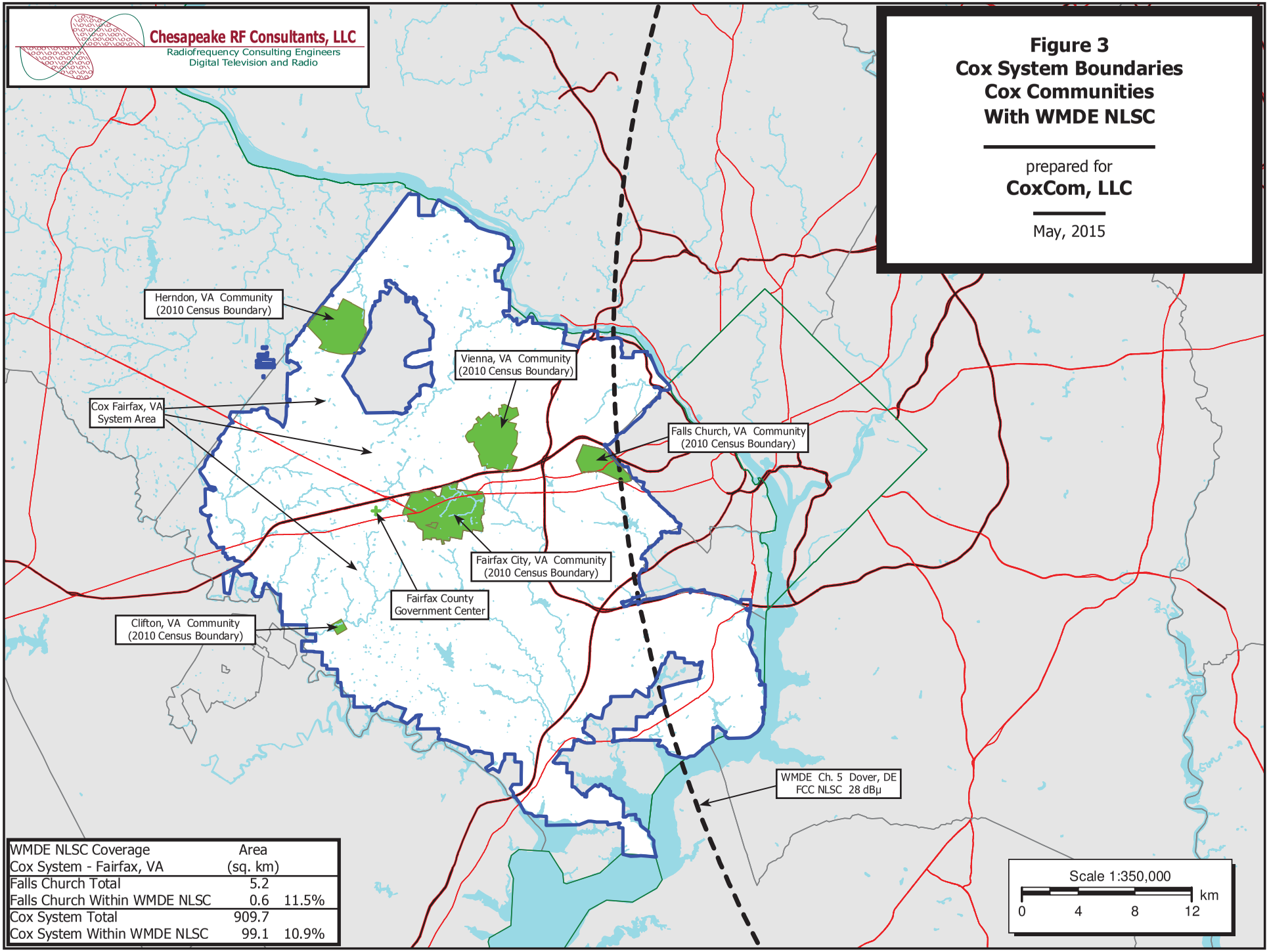
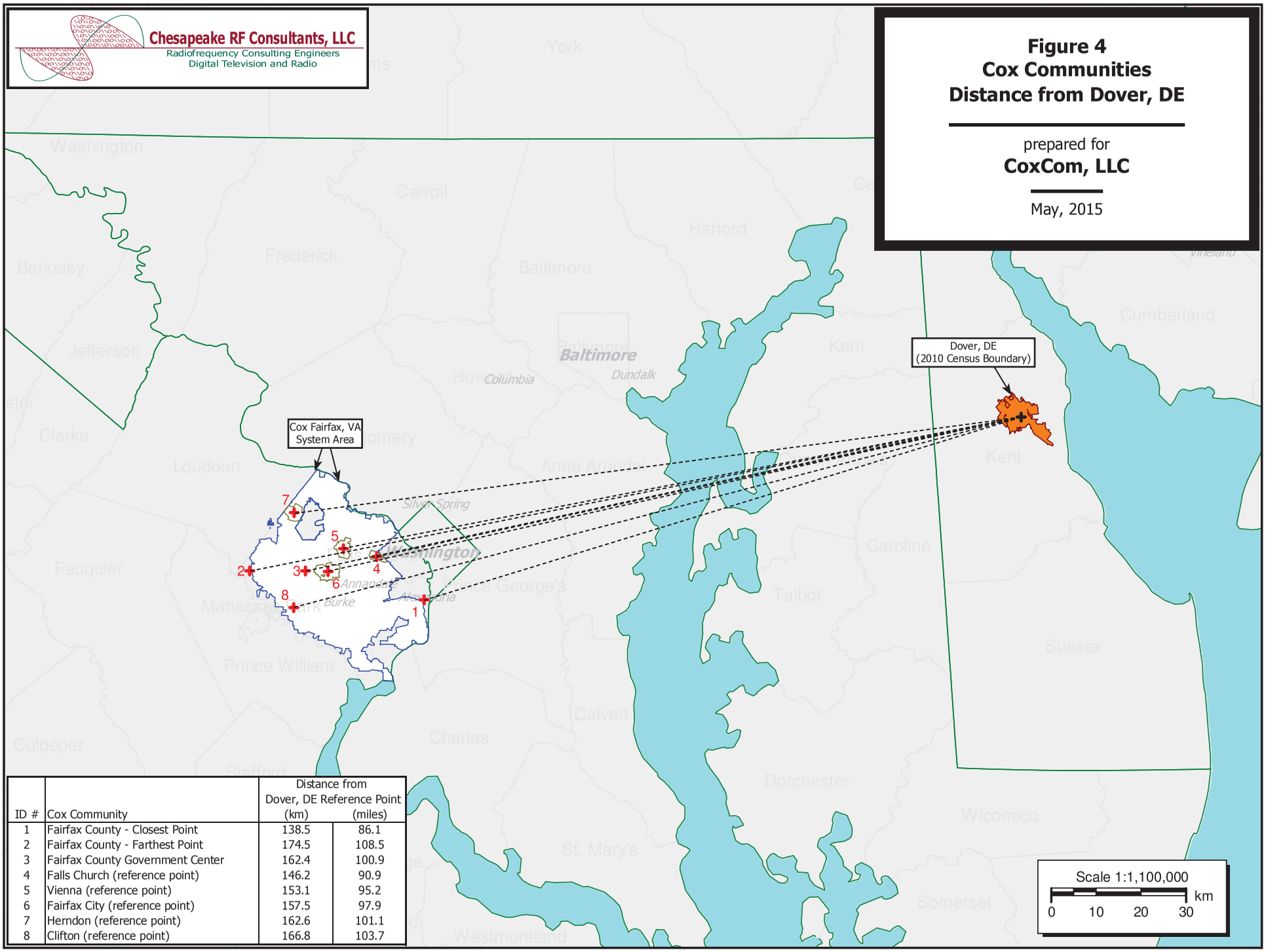


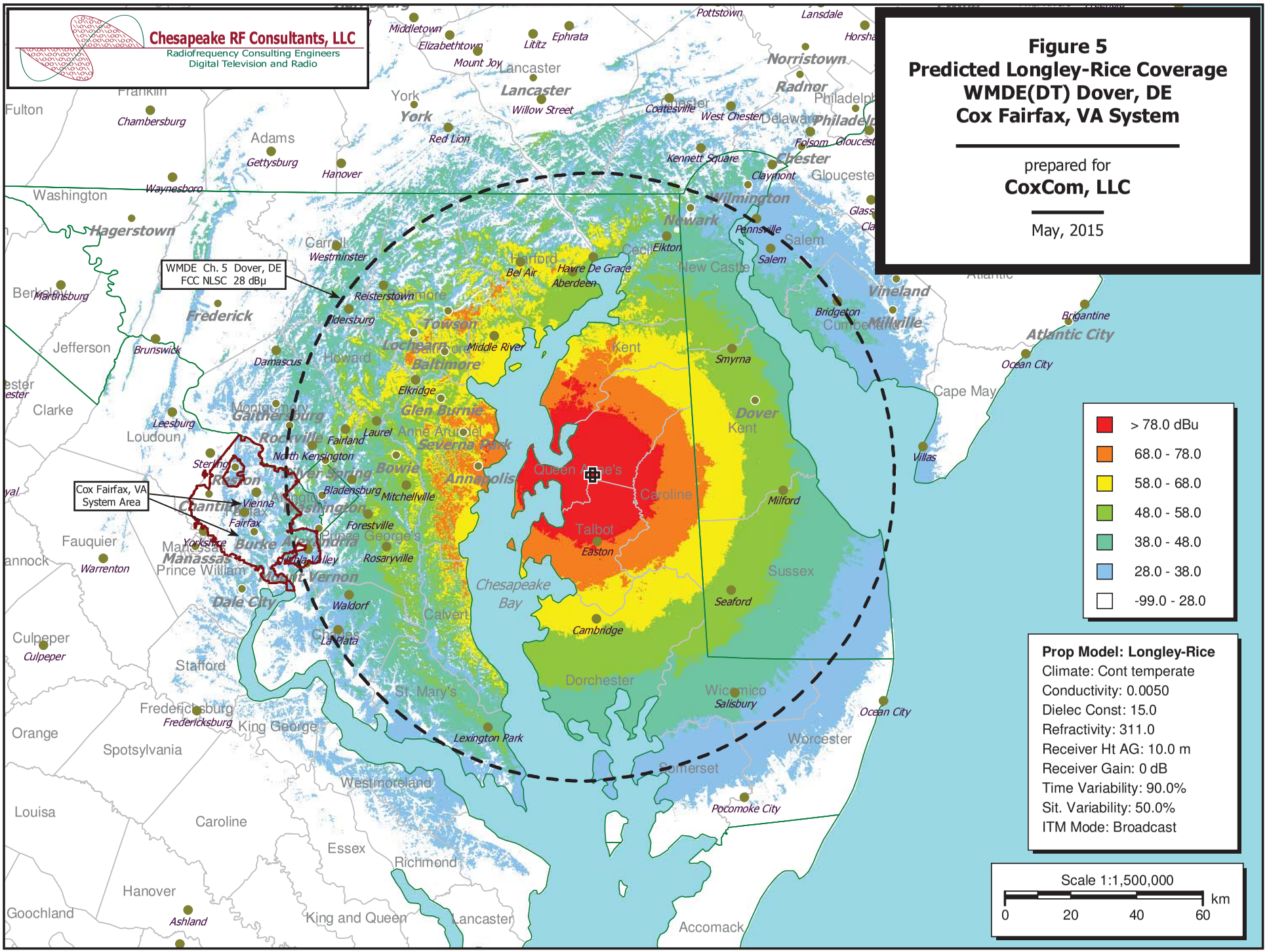
Figure 2
DMA and Cox System Boundaries
With WMDE NLSC
prepared for
CoxCom, LLC
May, 2015
Chesapeake RF Consultants, LLC
Radiofrequency Consulting Engineers
Digital Television and Radio
Allentown
Edison
Reading
Harrisburg
Trenton
Levittown
Philadelphia, PA DMA
Washington DC
(Hagerstown MD) DMA
Lancaster
Baltimore, MD DMA
Philadelphia
Wilmington
Vineland
Dover, DE
(2010 Census Boundary)
Baltimore
Cox Fairfax, VA
System Area
Silver Spring
WMDE
Site
Chesapeake
Bay
WMDE Ch. 5 Dover, DE
FCC NLSC 28 dBμ
DMA Key
Baltimore
Philadelphia
Washington DC
Scale 1:2,000,000
km
0
20
40
60



WMDE NLSC Coverage Cox System - Fairfax, VA	Area (sq. km)	
Falls Church Total	5.2	
Falls Church Within WMDE NLSC	0.6	11.5%
Cox System Total	909.7	
Cox System Within WMDE NLSC	99.1	10.9%



ID #	Cox Community	Distance from Dover, DE Reference Point (km)	(miles)
1	Fairfax County - Closest Point	138.5	86.1
2	Fairfax County - Farthest Point	174.5	108.5
3	Fairfax County Government Center	162.4	100.9
4	Falls Church (reference point)	146.2	90.9
5	Vienna (reference point)	153.1	95.2
6	Fairfax City (reference point)	157.5	97.9
7	Herndon (reference point)	162.6	101.1
8	Clifton (reference point)	166.8	103.7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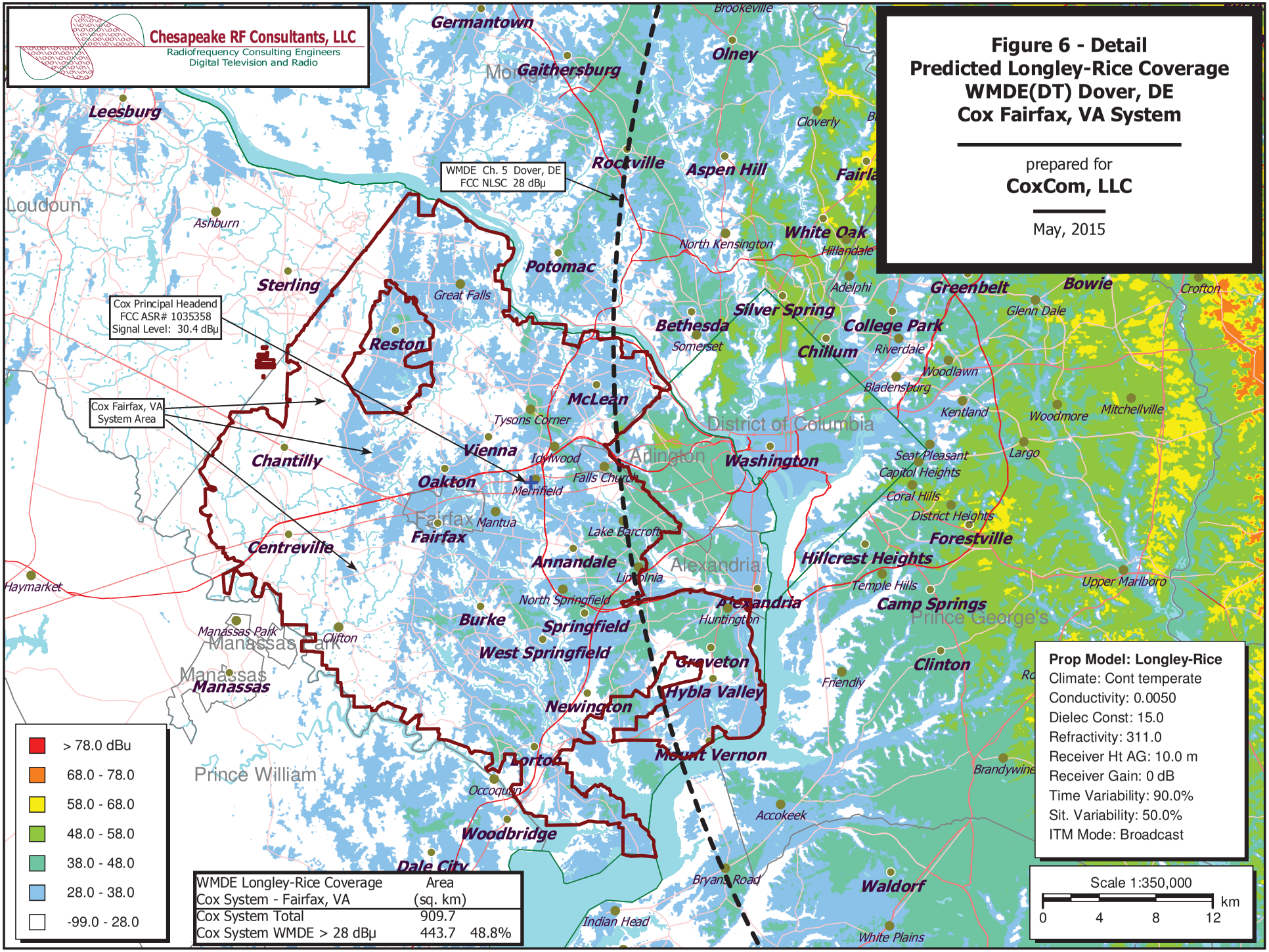
Radiofrequency Consulting Engineers
Digital Television and Radio
Figure 5
Predicted Longley-Rice Coverage
WMDE(DT) Dover, DE
Cox Fairfax, VA System
prepared for
CoxCom, LLC
May, 2015
WMDE Ch. 5 Dover, DE
FCC NLSC 28 dBµ
Cox Fairfax, VA
System Area
> 78.0 dBu
68.0 - 78.0
58.0 - 68.0
48.0 - 58.0
38.0 - 48.0
28.0 - 38.0
-99.0 - 28.0
Prop Model: Longley-Rice
Climate: Cont temperate
Conductivity: 0.0050
Dielec Const: 15.0
Refractivity: 311.0
Receiver Ht AG: 10.0 m
Receiver Gain: 0 dB
Time Variability: 90.0%
Sit. Variability: 50.0%
ITM Mode: Broadcast
Scale 1:1,500,000
0 20 40 60 km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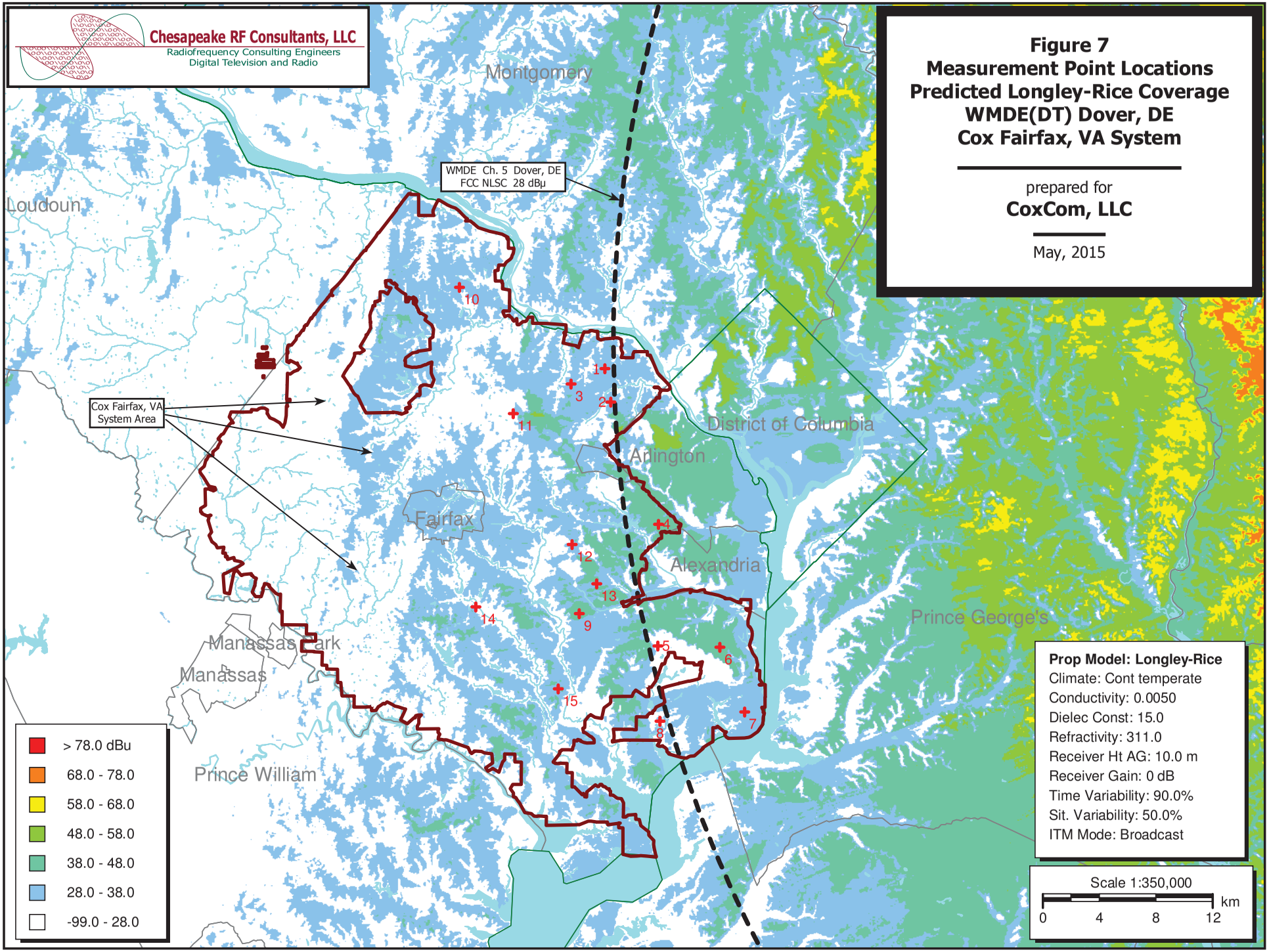
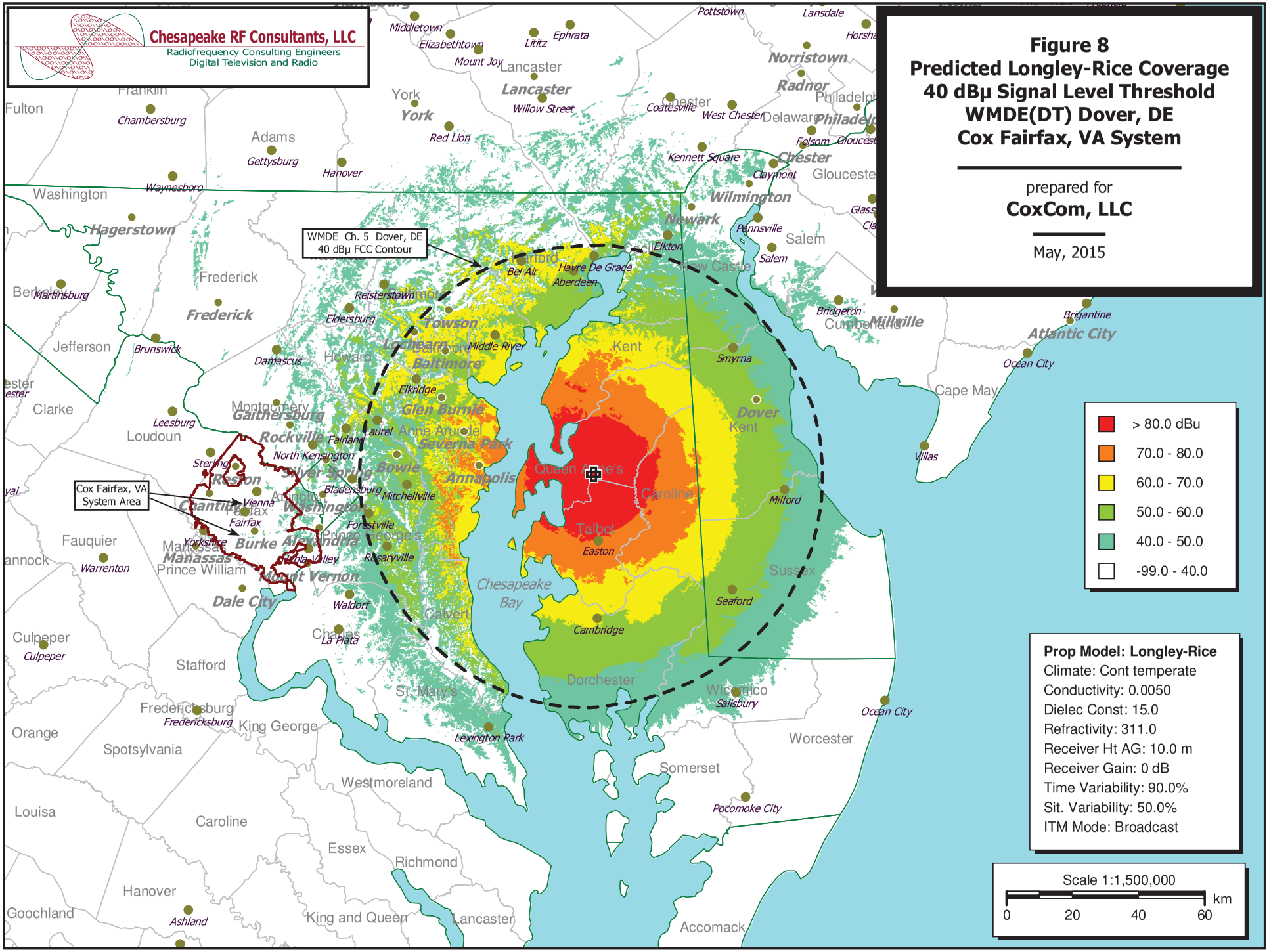
Digital Television and Radio
Figure 6 - Detail
Predicted Longley-Rice Coverage
WMDE(DT) Dover, DE
Cox Fairfax, VA System
prepared for
CoxCom, LLC
May, 2015
WMDE Ch. 5 Dover, DE
FCC NLSC 28 dBµ
Cox Principal Headend
FCC ASR# 1035358
Signal Level: 30.4 dBµ
Cox Fairfax, VA
System Area
Germantown
Gaithersburg
Olney
Brookeville
Leesburg
Rockville
Aspen Hill
Cloverly
Loudoun
Ashburn
White Oak
Hillandale
North Kensington
Potomac
Sterling
Great Falls
Adelphi
Greenbelt
Bowie
Crofton
Glenn Dale
Silver Spring
Bethesda
Somerset
College Park
Chillum
Riverdale
Woodlawn
Bladensburg
Reston
McLean
Tysons Corner
Kentland
Woodmore
Mitchellville
District of Columbia
Vienna
Idylwood
Arlington
Washington
Seat Pleasant
Capitol Heights
Largo
Chantilly
Oakton
Falls Church
Merrifield
Coral Hills
District Heights
Fairfax
Mantua
Lake Barcroft
Forestville
Centreville
Annandale
Hillcrest Heights
Alexandria
Lincolnia
Temple Hills
Upper Marlboro
Haymarket
North Springfield
Camp Springs
Burke
Springfield
Huntington
Prince George's
Manassas Park
Clifton
West Springfield
Clinton
Manassas
Graveton
Friendly
Hybla Valley
Newington
Mount Vernon
Lorton
Brandywine
Occoquan
Accokeek
Prince William
Woodbridge
Dale City
Bryans Road
Waldorf
Indian Head
White Plains
> 78.0 dBu
68.0 - 78.0
58.0 - 68.0
48.0 - 58.0
38.0 - 48.0
28.0 - 38.0
-99.0 - 28.0
WMDE Longley-Rice Coverage Cox System - Fairfax, VA | Area (sq. km)
Cox System Total 909.7
Cox System WMDE > 28 dBµ 443.7 48.8%
Prop Model: Longley-Rice
Climate: Cont temperate
Conductivity: 0.0050
Dielec Const: 15.0
Refractivity: 311.0
Receiver Ht AG: 10.0 m
Receiver Gain: 0 dB
Time Variability: 90.0%
Sit. Variability: 50.0%
ITM Mode: Broadcast
Scale 1:350,000
0 4 8 12 km


Chesapeake RF Consultants, LLC
Radiofrequency Consulting Engineers
Digital Television and Radio
Figure 7
Measurement Point Locations
Predicted Longley-Rice Coverage
WMDE(DT) Dover, DE
Cox Fairfax, VA System
prepared for
CoxCom, LLC
May, 2015
WMDE Ch. 5 Dover, DE
FCC NLSC 28 dBµ
Cox Fairfax, VA
System Area
Montgomery
Loudoun
District of Columbia
Arlington
Fairfax
Alexandria
Prince George's
Manassas Park
Manassas
Prince William
> 78.0 dBu
68.0 - 78.0
58.0 - 68.0
48.0 - 58.0
38.0 - 48.0
28.0 - 38.0
-99.0 - 28.0
Prop Model: Longley-Rice
Climate: Cont temperate
Conductivity: 0.0050
Dielec Const: 15.0
Refractivity: 311.0
Receiver Ht AG: 10.0 m
Receiver Gain: 0 dB
Time Variability: 90.0%
Sit. Variability: 50.0%
ITM Mode: Broadcast
Scale 1:350,000
km
0
4
8
12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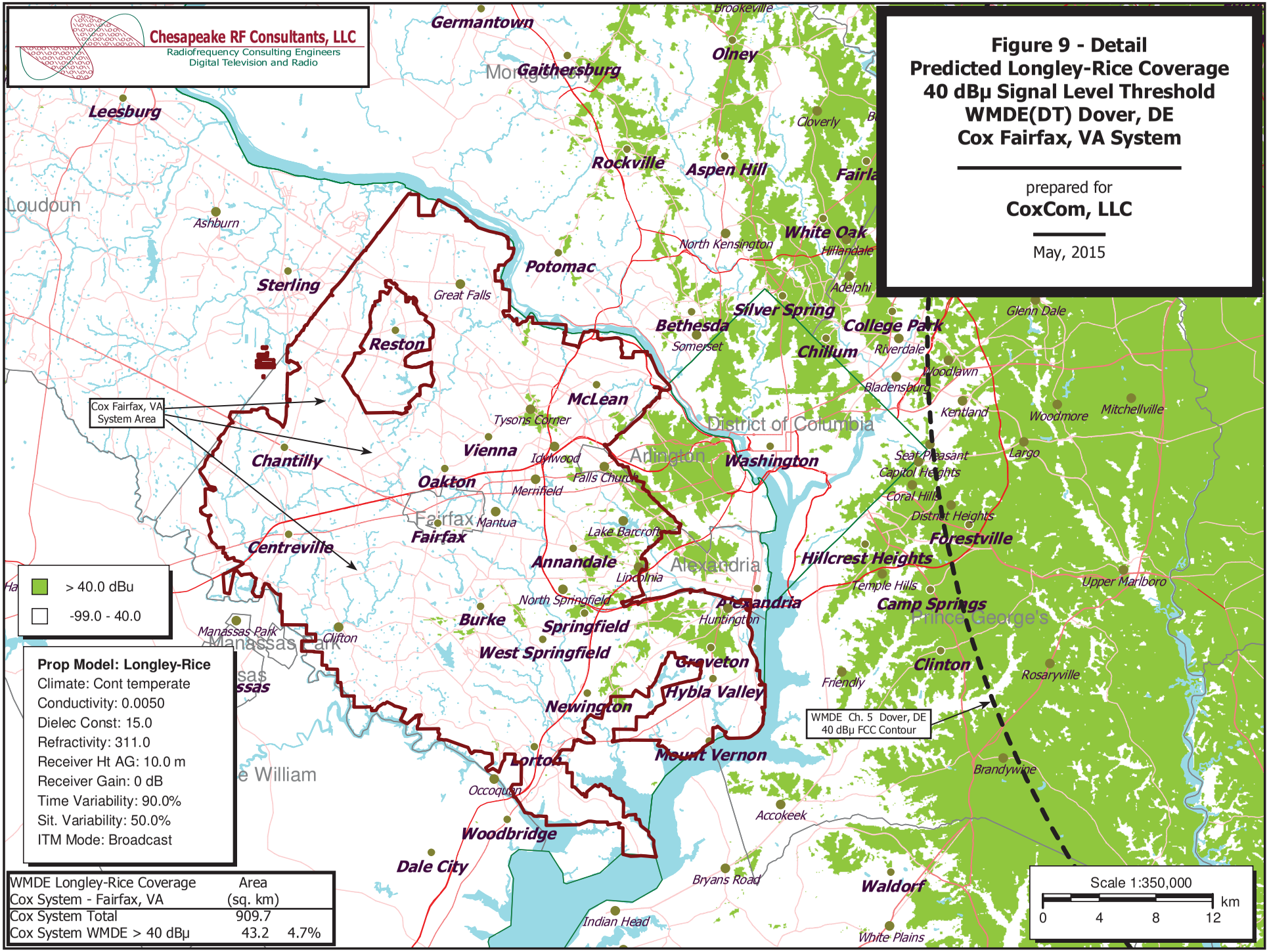
Digital Television and Radio
Figure 8
Predicted Longley-Rice Coverage
40 dBμ Signal Level Threshold
WMDE(DT) Dover, DE
Cox Fairfax, VA System
prepared for
CoxCom, LLC
May, 2015
WMDE Ch. 5 Dover, DE
40 dBμ FCC Contour
Cox Fairfax, VA
System Area
> 80.0 dBu
70.0 - 80.0
60.0 - 70.0
50.0 - 60.0
40.0 - 50.0
-99.0 - 40.0
Prop Model: Longley-Rice
Climate: Cont temperate
Conductivity: 0.0050
Dielec Const: 15.0
Refractivity: 311.0
Receiver Ht AG: 10.0 m
Receiver Gain: 0 dB
Time Variability: 90.0%
Sit. Variability: 50.0%
ITM Mode: Broadcast
Scale 1:1,500,000
0 20 40 60 km



WMDE Longley-Rice Coverage Cox System - Fairfax, VA	Area (sq. km)	
Cox System Total	909.7	
Cox System WMDE > 40 dBµ	43.2	4.7%